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Research article

Associations Between Pain Intensity, Fatigue, and Demographic Factors in Adults With Chronic Low Back Pain: A Cross-Sectional Study

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Abstract: Pain and fatigue are common symptoms in clinical and occupational health, yet their relationship with functional factors remains complex. This study was meant to investigate how age, gender, occupation, pain intensity, fatigue (measured by the Fatigue Assessment Scale—FAS), and functional status interact in a general adult population. Understanding these associations is important for establishing targeted therapeutic strategies and improving quality of life. A cross-sectional study was conducted on a sample of 297 adult respondents, consisting of 151 women (50.84%) and 146 men (49.16%), with an age range of 18 to 75 years (mean age = 42.3 years, SD = 13.7). Pearson's correlation analysis was used to evaluate linear relationships between age, gender, occupation, pain intensity, FAS score, and functional status. Pain and fatigue were assessed using validated scales, and demographic data were collected via structured questionnaires. Age showed a weak but statistically significant positive correlation with pain intensity ($r = 0.130$, $p = 0.025$), while gender exhibited a weak negative correlation ($r = -0.122$, $p = 0.032$), with women reporting higher pain levels. The strongest correlation was found between pain intensity and FAS score ($r = 0.232$, $p < 0.001$), indicating a close link between functional impairment and perceived pain. No significant associations were found between occupation and either pain ($r = -0.047$, $p = 0.419$) or functional status ($r = -0.053$, $p = 0.364$). Age did not significantly correlate with fatigue ($r = -0.073$, $p = 0.211$), suggesting multifactorial influences beyond chronological aging. The findings suggest that demographic factors such as age and gender, along with functional status, play a more substantial role in pain and fatigue perception than occupational classification. These insights support the need for individualized physiotherapeutic approaches that consider personal and functional characteristics rather than professional background alone.

Keywords: Low back pain, Chronic fatigue, Fatigue Assessment Scale (FAS), Pain intensity, Occupational health

1. Introduction

Lumbar spine disorders are considered complex conditions involving anatomical, physiological, psychological, and social dimensions [**Error! Reference source not found.**]. In contemporary society, an increasing proportion of the population reports experiencing some form of discomfort in the lumbar region. This discomfort has become one of the leading causes of morbidity and work-related disability, not only among adults [**Error! Reference source not found.-Error! Reference source not found.**], but also in younger individuals [**Error! Reference source not found.,Error! Reference source not found.**].

Pain in the lumbar spine region encompasses three distinct sources: (1) lumbosacral pain, which includes discomfort localized to the lumbar vertebrae (L1–L5) and the sacral area (along the entire sacrum); (2) radicular leg pain, which radiates into the lower extrem-ity following a dermatomal pattern, typically caused by irritation of a spinal nerve or dor-sal root ganglion; and (3) referred pain, which spreads to areas distant from the source but does not follow a dermatomal pathway [**Error! Reference source not found.**,**Error! Reference source not found.**]. Scientific literature highlights various contributing factors to lumbar pain, with differing emphasis across studies. These include meteosensitivity [**Error! Reference source not found.**,**Error! Reference source not found.**], hypoactivity [**Error! Reference source not found.**], occupational environment [**Error! Reference source not found.**], and lifestyle factors [**Error! Reference source not found.**,**Error! Reference source not found.**]. Each of these aspects may influence the onset, persistence, or intensity of lumbar pain, underscoring the multifactorial nature of the condition. Several studies have identified obesity—characterized by elevated body mass index (BMI) and waist circumference (WC)—as a factor associated with lumbar spine pain [**Error! Reference source not found.**,**Error! Reference source not found.**]. However, researchers emphasize that the relationship between obesity and chronic low back pain is a complicated interaction that includes biomechanical, inflammatory, and psychosocial factors. From a biomechanical perspective, excess body weight, particularly abdominal fat, imposes increased load and stress on the lumbar spine in an anterior direction. This mechanical strain may contribute to structural changes and the development of pain. In terms of inflammation, adipose tissue is recognized as an endocrine organ that secretes adipokines, which may play a role in pain modulation and systemic inflammation [**Error! Reference source not found.**-**Error! Reference source not found.**].

Chronic pain is defined as pain in the lumbar spine region persisting for more than 12 weeks. However, up to one-third of patients report experiencing moderate - intensity back pain as a subjective symptom even one year after an acute episode [**Error! Reference source not found.**]. Fatigue is a common and clinically significant symptom among individuals with chronic lumbar pain [**Error! Reference source not found.**]. Patients frequently report substantially higher levels of fatigue compared to the healthy population [**Error! Reference source not found.**]. The general population frequently experiences fatigue, and research has well-documented its association with pain. Individuals with chronic conditions or persistent pain often report a high prevalence of fatigue. Those suffering from chronic lumbar pain frequently experience fatigue - related symptoms, with the majority also reporting limitations in physical functioning [**Error! Reference source not found.**].

2. Materials and Methods

2.1 Data Collection and Participant Selection

Data were collected using a standardized questionnaire comprising demographic items (age, gender, occupation), pain intensity assessment, and the Fatigue Assessment Scale (FAS). The study sample consisted of 297 participants who were randomly selected. Inclusion criteria required the presence of persistent pain in the lower lumbar spine last-ing for at least 12 consecutive months. All participants were under outpatient neurological care.

Exclusion criteria included any traumatic mechanism affecting the lumbar spine, specifically: (a) vertebral body fracture at one or more levels between L1 and L5, (b) fracture of the vertebral arch at one or more levels between L1 and L5, (c) vertebral dislocation in the L1–L5 region, (d) traumatic injury to ligaments or the stabilizing muscular corset, (e) spinal cord injury, and (f) damage to the spinal segment of the central nervous system. Participation in the study was voluntary.

Data were collected using an online questionnaire distributed via digital platforms, including social media and email. The questionnaire included demographic items, a standardized pain intensity assessment, and the Fatigue Assessment Scale

(FAS). The use of online distribution allowed for broader reach and efficient data acquisition from a di-verse population sample. To obtain statistically relevant data, a standardized instrument - the Fatigue Assessment Scale (FAS) was employed to evaluate chronic fatigue, supplemented by categorical questions. The primary purpose of using the FAS questionnaire was to assess the level of fatigue, encompassing both physical and mental exhaustion. The FAS consists of 10 items, each rated on a 5-point Likert scale ranging from 1 (never), 2 (sometimes), 3 (regularly), 4 (often), to 5 (always). In accordance with established guidelines, reverse scoring was applied to items 4 ("I have enough energy for everyday life") and 10 ("When I am doing something, I can concentrate well"), where the scale was inverted: 1 (always), 2 (often), 3 (regularly), 4 (sometimes), and 5 (never). The total FAS score was calculated by summing the responses to all items, resulting in a score range from 10 to 50. A score ≤ 21 indicates normal fatigue, 22–34 represents moderate fatigue, and ≥ 35 indicates severe fatigue.

Pain intensity was measured using a Visual Analogue Scale (VAS), consisting of a 10 cm horizontal line anchored by "no pain" (0) on the left and "worst imaginable pain" (10) on the right. Participants marked the point on the line that best represented their current pain intensity. The score was determined by measuring the distance in millimeters from the left anchor, with higher values indicating greater pain intensity [**Error! Reference source not found.**].

2.2 Variables and Definitions

Patients were categorized into three groups based on the type of work performed: sedentary employment, manual labor, and physically demanding work. In this study, sedentary employment was defined as occupational activity performed predominantly in a seated position, with an energy expenditure not exceeding 1.5 times the resting metabol-ic rate (MET), corresponding to the internationally recognized definition of sedentary be-havior [**Error! Reference source not found.**]. Typical examples include administrative tasks, computer work, or other activities per-formed in a static posture [**Error! Reference source not found.**,**Error! Reference source not found.**]. Manual labor was defined as occupational activity performed primarily through physical effort, requiring muscular strength, repetitive movements, or handling of objects, with energy expenditure exceeding that of sedentary behavior and corresponding to light to moderate physical activity (≥ 1.5 MET). Common examples include assembly work, machine operation, warehouse tasks, or agricultural activities [**Error! Reference source not found.**,**Error! Reference source not found.**]. Physically demanding work was defined as activity involving high physical exertion, requiring significant muscular strength, heavy lifting, or prolonged standing, associated with high energy expenditure (> 6 MET) [**Error! Reference source not found.**].

2.3 Limitations and Strengths

One of the key methodological limitations in epidemiological and occupational studies is the use of broad occupational categories, which may mask significant within-group differences in physical workload exposure. This issue is particularly relevant when assessing musculoskeletal risks, as job tasks within a single occupational group can vary substantially depending on the specific workplace, job description, work environment, and individual work habits.

The study by Brighenti-Zogg et al. [**Error! Reference source not found.**] demonstrated that even when workers were grouped according to the intensity of physical activity (low, moderate, high), substantial differences in actual physical demands were observed among individuals. Average values of VO_2max and energy expenditure did not reflect these individual variations, which may lead to misinterpretation of risk, inappropriate return-to-work decisions, or suboptimal planning of rehabilitation interventions.

Another critical issue is the use of standardized job classification systems, such as the International Standard Classification of Occupations (ISCO). While these systems facilitate international comparisons, they often fail to capture the specific characteristics of individual job roles, potentially resulting in misclassification of exposure and subsequent bias in study outcomes. This limitation is especially pronounced in studies relying on Job-Exposure Matrices (JEMs), where exposure is estimated based on average values for a given occupational category, without accounting for individual-level variability.

2.4 Statistical Analysis

Data were analyzed using descriptive statistics (mean, standard deviation, median, and interquartile range). Statistical significance was set at the level of $p < 0.05$. Results are presented as mean ± SD and 95% confidence intervals. The analysis was conducted using IBM SPSS software.

The participants were informed and enlightened about the progress of the study. They agreed to participate by signing the informed consent form. The examination of the
participants was carried out in accordance with the principles of the Helsinki Declaration of Human Rights and was approved by the Ethics Committee of the Central Military Hospital in Ružomberok.

3. Results

In the studied sample of adults, predominantly of middle age (≈44 years), the popula-tion was gender - balanced and occupationally heterogeneous. The study included a total of 297 participants. The mean age of respondents was 44.32 ± 12.94 years, with a median of 45 years (IQR 33–53), ranging from 18 to 76 years. Regarding gender distribution, there were 151 women (50.84%) and 146 men (49.16%). Occupational classification was as fol-lows: sedentary employment (n = 131; 44.11%), manual labor (n = 71; 23.90%), and physi-cally demanding work (n = 95; 31.99%) (Table 1).

Table 1. Descriptive Statistics of Group

		Sex	Age	Occupation
N	Valid	297	297	297
		Men: n = 146 (49.16%) Women: n = 151 (50.84%)		Sedentary employment: n = 131 (44.11%) Manual labor: n = 71 (23.90%) Physically demanding work: n = 95 (31.99%)
Mean		1.49	44.32	1.88
Median		1.00	45.00	2.00
Mode		1	32	1

As part of the correlation analysis (Table 2), we examined the relationship between pain intensity, age, and gender in a sample of 297 respondents. The results indicated that pain intensity was positively correlated with age ($r = 0.130$, $p < 0.05$), suggesting that older individuals may experience higher levels of pain. Gender showed a weak negative correlation with pain intensity ($r = −0.122$, $p < 0.05$), with women tending to report higher pain intensity. The strongest correlation was observed between pain intensity and FAS score ($r = 0.232$, $p < 0.01$), indicating a significant relationship between functional status and pain perception. These findings support the hypothesis that demographic factors and functional status may influence the subjective experience of pain.

Table 2. Pearson correlation

		Occupation	Age	Sex	Pain Intensity	FAS score
Occupation	Pearson Correlation	1	,045	,099	-,047	-,053
	Sig. (2-tailed)		,442	,089	,419	,364
Age	Pearson Correlation	,045	1	,072	,130*	-,073
	Sig. (2-tailed)	,442		,217	**,025**	,211
Sex	Pearson Correlation	,099	,072	1	-,122*	-,145*
	Sig. (2-tailed)	,089	,217		**,036**	**,013**
Pain Intensity	Pearson Correlation	-,047	,130*	-,122*	1	,232**
	Sig. (2-tailed)	,419	**,025**	**,036**		**,000**
FAS score	Pearson Correlation	-,053	-,073	-,145*	,232**	1
	Sig. (2-tailed)	,364	,211	**,013**	**,000**	
	N	297	297	297	297	297

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The linear association between age and fatigue, as measured by the Fatigue Assess-ment Scale (FAS), was evaluated using Pearson's correlation coefficient (two-tailed testing, $\alpha = 0.05$). In the analyzed sample (N = 297), a weak, negative, and statistically non-significant correlation was observed between age and FAS score ($r = -0.073$, 95% CI [−0.185, 0.041], $p = 0.211$). These results do not indicate the presence of a reliable linear re-lationship between age and fatigue levels in our sample.

For completeness, we report related associations within the same dataset: FAS scores were positively correlated with pain intensity ($r = 0.232$, $p < 0.001$), while age showed a weak positive correlation with pain intensity ($r = 0.130$, $p = 0.025$). These findings are con-sistent with the assumption that higher pain levels are associated with greater fatigue, whereas age may be a secondary, albeit weak, factor contributing to pain perception.

Correlation analysis between occupation, pain intensity, and functional status (FAS score) did not reveal any statistically significant relationships. The correlation between oc-cupation and pain intensity was fragile ($r = -0.047$, $p = 0.419$), as was the correlation be-tween occupation and FAS score ($r = -0.053$, $p = 0.364$). These results suggest that occupa-tional classification does not significantly influence subjective pain perception or func-tional status. It may be inferred that other factors, such as age, gender, or health status, play a more substantial role in this context.

Figure 1. Frequency Distribution of Values

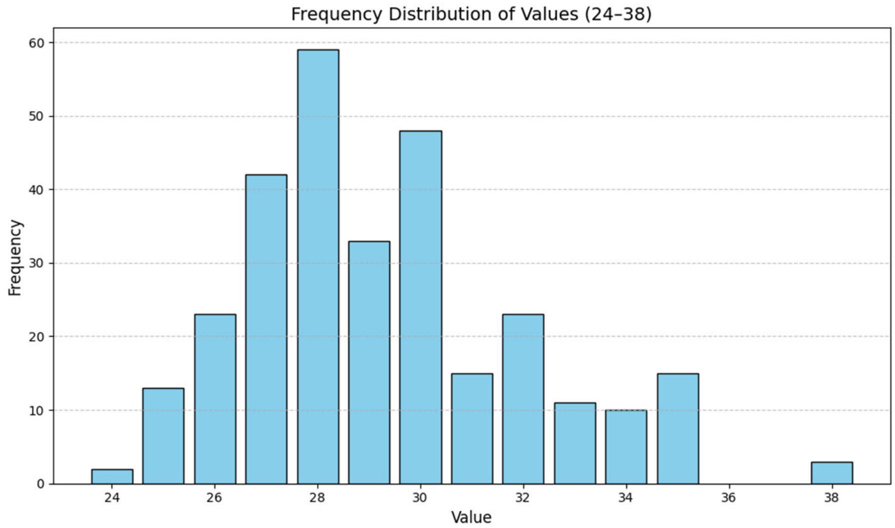

Figure 1 presents the frequency distribution of values ranging from 24 to 38. The most frequently observed value is 28 (n = 59), followed by 30 (n = 48) and 27 (n = 42). This distribution indicates a moderate concentration around the central values. The distribution of FAS scores within the studied population (n = 297) exhibits right-skewness (skewness = 0.71), suggesting that the majority of respondents achieved lower scores. The mean score was 29.28, with the most frequently occurring value being 28. The minimal difference between the mean and the median points to a relatively consistent distribution. A standard deviation of 2.72 indicates moderate variability within the dataset.

4. Discussion

Results of the correlation analysis indicate that pain intensity positively correlates with age ($r = 0.130$, $p < 0.05$), supporting previous findings that older individuals tend to report higher levels of pain. For instance, a study published in The Journals of Gerontology demonstrated that chronic pain increases with age, particularly in countries with limited access to healthcare [**Error! Reference source not found.**]. Zhi et al. [**Error! Reference source not found.**] found that older adults exhibit a higher threshold for thermal pain but a reduced ability to differentiate pain intensity. García-Domínguez [**Error! Reference source not found.**] further highlights molecular changes in the nervous system that contribute to increased pain sensitivity in the elderly.

Gender showed a weak negative correlation with pain intensity ($r = -0.122$, $p < 0.05$), with women tending to report higher pain levels. This finding aligns with a review by the International Association for the Study of Pain [**Error! Reference source not found.**]. Alexander et al. [**Error! Reference source not found.**] describe sex-based differences in neuroimmune communication, noting that estrogen enhances TRPV1 receptor sensitivity. Gazerani et al. [**Error! Reference source not found.**] underscore the necessity of implementing gender-specific strategies for pain management, given that chronic pain conditions disproportionately impact women.

The strongest correlation was observed between pain intensity and FAS score ($r = 0.232$, $p < 0.01$), indicating a significant relationship between functional status and pain perception. Vallerand et al. [**Error! Reference source not found.**] report that impaired functional status is associated with increased pain and reduced quality of life. Steinruecke et al. [**Error! Reference source not found.**] confirm that chronic pain is prevalent among patients with functional neurological disorders. Kim et al. [**Error!

Reference source not found.] demonstrated that pain treatment can lead to reversible changes in brain structure, suggesting a close link between functional status and neuroplasticity.

Our findings support the hypothesis that demographic factors and functional status significantly influence the subjective experience of pain. Macchia et al. [**Error! Reference source not found.**] identified higher pain prevalence among women, older adults, and individuals with lower educational attainment. Okolo et al. [**Error! Reference source not found.**] show that cultural norms affect both verbal and non-verbal expressions of pain. Rogger et al. [**Error! Reference source not found.**] emphasize that cultural frameworks shape not only pain perception but also treatment-seeking behavior and communication with healthcare providers.

No statistically significant correlation was found between age and fatigue as measured by the FAS ($r = -0.073$, $p = 0.211$), suggesting the absence of a reliable linear relationship between these variables in our sample. This result is consistent with meta-analyses indicating that although fatigue is common among older adults, its prevalence and severity vary depending on the assessment tool, health status, and cultural context [**Error! Reference source not found.**]. Similarly, Peterson et al. [**Error! Reference source not found.**] found that higher age was associated with lower fatigue scores in certain subscales, implying that fatigue may not increase linearly with age but is influenced by factors such as physical activity, sedentary behavior, and perceived health. Validation of the Pittsburgh Fatigability Scale in hospitalized seniors further supports the complexity of fatigue perception, even in the absence of clear physiological causes [**Error! Reference source not found.**].

FAS scores positively correlated with pain intensity ($r = 0.232$, $p < 0.001$), reinforcing the assumption that greater pain is associated with higher fatigue. This relationship is well documented in the literature; for example, Yamada et al. [**Error! Reference source not found.**] showed that pain intensity predicts subsequent fatigue in patients with musculoskeletal disorders. Pinheiro et al. [**Error! Reference source not found.**] found that physical fatigue and lack of energy are strong predictors of limitations in social and recreational activities among individuals with chronic pain. A complementary study published in The Journal of Pain confirmed that pain predicts later fatigue, while the reverse relationship was not supported, suggesting a possible causal direction from pain to fatigue [**Error! Reference source not found.**].

The weak positive correlation between age and pain intensity ($r = 0.130$, $p = 0.025$) suggests that age may be a contributing but not dominant factor in pain perception. Given the frequent comorbidity of pain and fatigue, it is essential to examine their interaction within the context of demographic variables. Research indicates that fatigue is more prevalent among women, individuals with lower education, and those in physically demanding occupations, with chronic fatigue affecting approximately 10% of the adult population [**Error! Reference source not found.**]. Moreover, demographic factors such as age, gender, education, and occupational stress significantly influence fatigue levels and perceived social support among healthcare workers [**Error! Reference source not found.**]. A systematic meta-analysis published in Frontiers in Public Health confirms that fatigue is more common among women, in specific professions, and among individuals with lower socioeconomic status [**Error! Reference source not found.**].

Correlation analysis between occupation, pain intensity, and FAS score did not reveal statistically significant relationships. The correlation between occupation and pain intensity was fragile ($r = -0.047$, $p = 0.419$), as was the correlation between occupation and FAS score ($r = -0.053$, $p = 0.364$). These findings suggest that occupational classification does not significantly influence subjective pain perception or functional status.

Similar conclusions were drawn by Fisher et al. [**Error! Reference source not found.**], who found that individual coping strategies and emotional support had a greater impact on pain management than occupational role. Blake et al. [**Error! Reference source not found.**] reported that employees with chronic pain faced insufficient workplace support, with managerial behavior and working conditions playing a more decisive role than job type. A study published in Occupational and Environmental Medicine also indicated that night shifts may acutely increase lower limb pain, but no general occupational effect on pain was confirmed [**Error! Reference source not found.**].

The correlation between occupation and functional status was likewise nonsignificant. Jiao et al. [**Error! Reference source not found.**] demonstrated that functional status in older adults with chronic conditions is primarily influenced by the quality of social relationships rather than occupational role. Amlak et al. [**Error! Reference source not found.**] confirmed in a global meta-analysis that functional disability is more prevalent among individuals over 80 years of age, women, those with low income, and those with multiple comorbidities—occupation was not a significant predictor.

It can therefore be assumed that other factors such as age, gender, and health status play a more substantial role in this context. Alagappan and Vajpayee [**Error! Reference source not found.**] showed that pain intensity is strongly associated with levels of depression and anxiety, with age and gender significantly affecting psychological well-being in patients with chronic pain. Macchia et al. [**Error! Reference source not found.**] found that pain is most frequently reported among women, older adults, widowed individuals, and those with lower education, while occupation was not a significant predictor. Fishman [**Error! Reference source not found.**] further demonstrated that after controlling for education and income, occupational prestige had no direct impact on health, although specific job types (e.g., construction, transportation) were associated with higher rates of functional limitations.

5. Conclusions

The results of the correlation analysis confirm that pain intensity tends to increase slightly with age, which aligns with international studies on aging and chronic pain. Gender emerged as a weak but statistically significant factor, with women demonstrating higher sensitivity to pain. The strongest association was observed between pain intensity and functional status, indicating a close link between physical condition and pain percep-tion. These findings support the hypothesis that demographic factors such as age, gender, and education significantly influence the subjective experience of pain. The correlation be-tween age and fatigue was not statistically significant, suggesting the complexity of this symptom. Fatigue appears to be a multifactorial phenomenon influenced by lifestyle, health status, and cultural context. Pain and fatigue are frequently comorbid, with higher pain levels predicting increased fatigue. Occupational classification did not show a signif-icant impact on either pain or functional status, a conclusion supported by several stud-ies. More influential than occupation are individual factors such as movement technique, posture, and psychological well-being. Overall, the assessment of pain and fatigue re-quires a comprehensive approach that considers a range of biological, psychological, and social variables.

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